WHAT IS CLAIMED IS:

1. A method to increase the throughput of a recovery boiler equipped with at least two levels of injection of air, the method comprising operating the boiler with oxygen enrichment of the air in at least one level of the combustion air system, at or above the secondary air level.

2. Method in accordance with claim 1 wherein the recovery boiler has primary and secondary levels of injection air.

3. Method in accordance with claim 1 wherein the recovery boiler has primary, secondary, and tertiary levels of injection air.

4. Method in accordance with claim 3 wherein the recovery boiler has the same oxygen enrichment levels in the secondary and tertiary air.

5. Method in accordance with claim 3 wherein the recovery boiler has one oxygen enrichment level in the secondary air and a different oxygen enrichment level in the tertiary air.

6. Method in accordance with claim 1 wherein the recovery boiler has oxygen concentrations in combustion oxidant up to 30% in at least the secondary level of combustion air.

7. Method in accordance with claim 1 wherein the recovery boiler has oxygen concentrations up to 30% in the primary and the secondary level of combustion air.

8. Method in accordance with claim 3 wherein the recovery boiler has oxygen concentrations in combustion oxidant up to 30% in the primary, secondary, and tertiary levels of combustion air.

9. Method in accordance with claim 3 wherein the recovery boiler has primary, secondary, and tertiary levels of injection air, with oxygen enrichment in at least one of said levels of injection air, and further oxygen injection at a liquor gun level.

10. A method to increase the throughput of a recovery boiler equipped with at least two levels of injection of air, comprising operating the recovery boiler with a third level of oxidant injection below or at the same level as the original secondary air, and oxygen enrichment applied to at least the original secondary air stream and said third level. A more preferred embodiment of this method is to place the third level at a level lower than the level of the black liquor injection guns and higher than the primary air level. Once retrofitted to three levels of air injection, the two upper levels of air injection are re-named: said third level becomes the secondary level, and said original secondary level becomes the tertiary level.

11. Method in accordance with claim 10 wherein the third level is placed at or close to the same level as black liquor injector ports.

12. Method in accordance with claim 10 comprising injecting the third level of oxygen enriched air at the same level as the secondary air injection ports, using new oxidant nozzles.

13. Method in accordance with claim 10 wherein the third level is operated at a level lower than the level of the black liquor injection guns and higher than the primary air level.

14. Method in accordance with claim 10 wherein the recovery boiler has

oxygen concentrations in combustion oxidant up to 30% in at least the secondary level of combustion air.

15. A method to increase the throughput of a recovery boiler applicable to boilers with at least three air injection levels, or boilers with two air injection levels is retrofitted to three levels, the method comprising injecting oxygen at least at the secondary and the tertiary air levels.

16. Method in accordance with claim 15 wherein oxygen enrichment is applied to the primary air stream in addition to the secondary and tertiary air streams.

17. Method in accordance with claim 15 wherein recovery boiler has the same oxygen enrichment levels in the secondary and tertiary air, the oxygen enrichment levels being greater than 21%.

18. Method in accordance with claim 15 wherein the recovery boiler has different oxygen enrichment levels in each air level, the concentration of oxygen being greater than 21% in each air injection level.

19. A method of increasing the throughput of a recovery boiler applicable to boilers with at least four air injection levels, the four levels being primary, secondary, third and fourth levels, the method comprising applying oxygen enrichment to at least the secondary and one or more of third and fourth air levels.

20. Method in accordance with claim 19 wherein oxygen enrichment is applied to the primary air injection level in addition to the secondary and fourth air injection levels.

21. Method in accordance with claim 19 wherein the recovery boiler has the

same oxygen enrichment levels in the primary, secondary and tertiary air injection levels, the oxygen enrichment levels being greater than 21%.

22. Method in accordance with claim 19 wherein the recovery boiler has different oxygen enrichment levels in each air level, the concentration of oxygen being greater than 21% in each air injection level.

23. Method in accordance with claim 19 wherein the recovery boiler has oxygen concentrations in combustion oxidant up to 30% in the primary, secondary, and tertiary levels of combustion air.

24. Method in accordance with claim 19 wherein the recovery boiler has oxygen concentrations in combustion oxidant up to 30% in the primary, secondary, third and fourth levels of combustion air.

25. A method of controlling the oxygen concentration in the flue gas of a recovery boiler when oxygen enrichment of the combustion air is applied, the method being applicable to boilers with at least three levels of air injection, or a recovery boiler with an original two level air injection system retrofitted to three levels as described above, said method including the steps of:

a) supplying oxygen flows to at least two combustion air levels of the recovery boiler, said two combustion air levels being different from the primary air level, for oxygen enrichment of the said two combustion air levels;

b) selecting a desired oxygen concentration in the flue gas called set point concentration,

c) sensing the oxygen concentration in the flue gas;

d) adjusting the oxygen flow injected in the tertiary combustion air level, in order to maintain the sensed oxygen concentration at about the set point

oxygen concentration, while maintaining the flow of oxygen in the secondary level combustion air constant.

26. A method of controlling the oxygen concentration in the flue gas of a recovery boiler when oxygen enrichment of the combustion air is applied, the method being applicable to boilers with at least four levels of air injection, the method comprising the steps of:

a) supplying oxygen flows to at least two combustion air levels of the recovery boiler, said two combustion air levels being different from the primary air level, for oxygen enrichment of the said two combustion air levels;

b) selecting a desired oxygen concentration in the combustion products called set point concentration;

c) sensing the oxygen concentration in the flue gas;

d) adjusting the oxygen flow injected in the upper most combustion air level, in order to maintain the sensed oxygen concentration at about the set point oxygen concentration, while maintaining the flow of oxygen in the other level of combustion air constant.

27. A method to improve the combustion stability or chemical recovery of a recovery boiler where oxygen enrichment is applied to at least one level of the combustion air system at the primary air level comprising the steps of:

a) supplying oxygen flows to the primary combustion air level of the recovery boiler for oxygen enrichment of the primary air,

b) sensing either one or all of the following quantities: reduction efficiency of the smelt, sulfur dioxide SO_2 concentration in flue gas, or bed temperature;

c) adjusting the oxygen flow injected in the primary combustion air level, in order to obtain at least one of the following effects on either or all of the

following quantities: reduction efficiency above 90% and minimize SO_2 emissions.

28. A method to improve the combustion stability or chemical recovery of a recovery boiler where oxygen enrichment is applied to at least one level of the combustion air system at the secondary air level, the method comprising the steps of:

a) sensing either one or all of the following quantities: the reduction efficiency of the smelt, the sulfur dioxide SO_2 concentration in the flue gas, or the bed temperature;

b) adjusting the oxygen flow injected in the secondary combustion air level, in order to obtain the following effects on either or all of the following quantities: keep the reduction efficiency above 90%, minimize the SO_2 emissions.

29. Method in accordance with claim 28 wherein the oxygen concentration in the oxidant in each level of oxygen enriched air injection is controlled independently.

30. A method of controlling temperature profile in a recovery boiler when oxygen enrichment of the combustion air is applied, said method including the steps of:

a) supplying oxygen flows to at least two combustion air levels of the recovery boiler, said two combustion air levels being different from the primary air level, for oxygen enrichment of the said two combustion air levels

b) selecting an optimal temperature profile for the boiler based on the prior knowledge of the boiler operation, called set point temperature profile,

c) sensing average temperatures at different levels of the boiler with an optical technique, and inferring a temperature profile for the boiler, adjusting the oxygen flow injected in said at least two combustion air levels so that the measured temperature profile matches the boiler set point temperature profile.